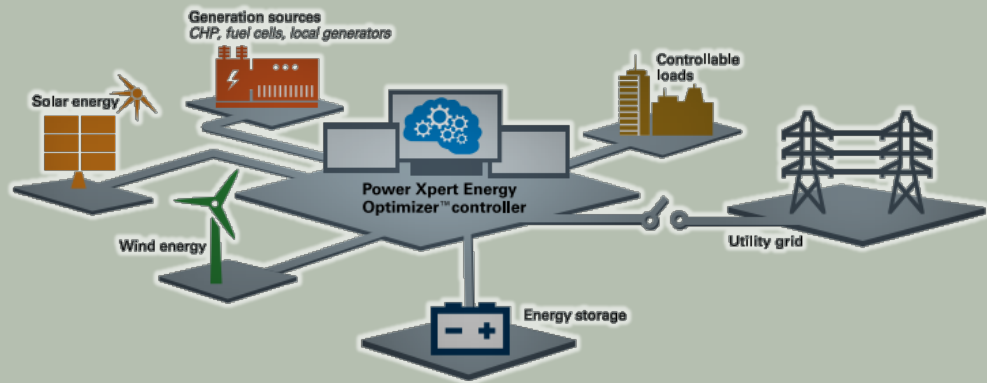


Cuyahoga County Dept. of Sustainability

RFI for Cuyahoga County Utility & Microgrids

July 15, 2022



Eaton Headquarters Beachwood OH



Powering Business Worldwide

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Section 1 Eaton Introduction

Eaton is pleased to present this microgrid response to the Cuyahoga County Department of Sustainability RFI. Eaton is a trusted energy partner and global leader in renewables, distributed energy resources, electricity system infrastructure, and energy retail and are well-suited to provide microgrid solutions to its customers.

Eaton's Electrical Engineering Systems & Services (EESS) team offers a comprehensive portfolio of services and products tailored for every lifecycle stage of the power distribution system. Through EESS's design, build, and support services, we are dedicated to understanding our client's needs and ensuring that the entire electrical infrastructure functions at its highest level. EESS and its partners have extensive combined experience in delivering a variety of solutions including demand response, engineered solutions and electrical equipment for new construction, electrical power system upgrades, distributed power integration, and rebuilding existing facilities. We also have extensive experience building and operating microgrid systems that deliver resilience, sustainability, and cost savings to critical industrial facilities at risk to power disruptions from natural disasters.

Eaton can assist and advise communities and enterprises develop, execute, and refine customized energy management strategies to reduce energy spend, bolster operational resilience, and generate additional value utilizing cutting edge energy technologies like battery storage and microgrids.

Eaton would assist and advise Cuyahoga County in its mission of delivering transformative technologies to its customers by bringing the following attributes:

- Global footprint and capabilities: Eaton and its partners are active in 28 countries across North and South America, Europe, Asia and Oceania, and our platforms enable us to rapidly enter new markets and scale our solutions.
- Shared principles and values: Eaton strives to solve some of the world's greatest challenges. Eaton's Everything as a Grid strategy brings secure and sustainable energy to more people through intelligent power management technologies complements the County's purpose to help build a better world, where every person is free to move and pursue their dreams.
- End-to-end project development and delivery capabilities: Eaton manages the full project life cycle leveraging the strength of Eaton and our partner's teams to support the goals of the project. This begins at early conceptualization and continues through from development to engineering, procurement, construction, and commissioning. From there, once the system is operational, we manage ongoing operations, economic optimization, enrollment and management of market participation and demand response programs, and maintenance providing

the software, tools, and personnel necessary to ensure maximized value from the project for the end-use customer.

- Eaton has the experience leading teams or being part of teams in completing projects of this nature. We are very flexible in a scope of services that are custom to a particular project and the customers' requirements.
- Eaton and its partners have extensive experience securing and managing incentives to improve project economics: Eaton and its partners have a proven track-record of securing and managing incentive programs that can boost project economics and support the development of innovative sustainable solutions, at the federal, state, and local levels. Thanks to our experience in building and operating battery storage projects and our deep understanding of the associated risks and opportunities, we can offer comprehensive guarantees on both the technical and financial performance of our solutions. We provide our solutions wrapped in a commercial offer (including financing when needed) that generally aligns incentives and minimizes risks to our end-use customer.
- Demonstrated track record delivering microgrids, storage, and other complex energy and infrastructure projects: Eaton has nearly 200MW of microgrids of various sizes in process or completed across industry segments in North America including utility, government/military, commercial and industrial and mission critical microgrids in Puerto Rico (press release) – please see the list of selected reference projects later in the document for further details.
- A portfolio of energy solutions complimentary to microgrids and energy storage: Eaton offers a complete suite of customized and integrated energy solutions to assist enterprises in achieving their energy cost reduction and sustainability goals. Eaton and its partners have solutions like Demand Response, Distributed Generation, EV charging and fleet management that can be bundled with Battery Energy Storage in a tailor-made Energy as a Service offerings that can enhance the value generated for Cuyahoga County customers.

Eaton is well-equipped to help Cuyahoga County navigate the challenges of valuing Microgrid projects with end-use customers and through our partners can provide financing and flexible commercial structures to suit market needs.

As each microgrid project is unique, Eaton can work with Cuyahoga County's end-use customers to define economic assumptions and estimate payback periods early in the design process to ensure aligned understanding of financial objectives. In certain states and geographies, especially those with incentives or where power interruptions are frequent, payback periods for microgrid projects can be 2-4 years or less once the avoided cost of such interruptions is accounted for. In other geographies with lower costs of power or fewer market services programs available, payback periods are generally longer and can exceed 6-8 years.

While some end-use customers are attracted to these payback periods, others prefer to provide financing under an Energy-as-a-Service or Shared Value models such that the project generates savings/revenues with no upfront cost to the customer. Through these

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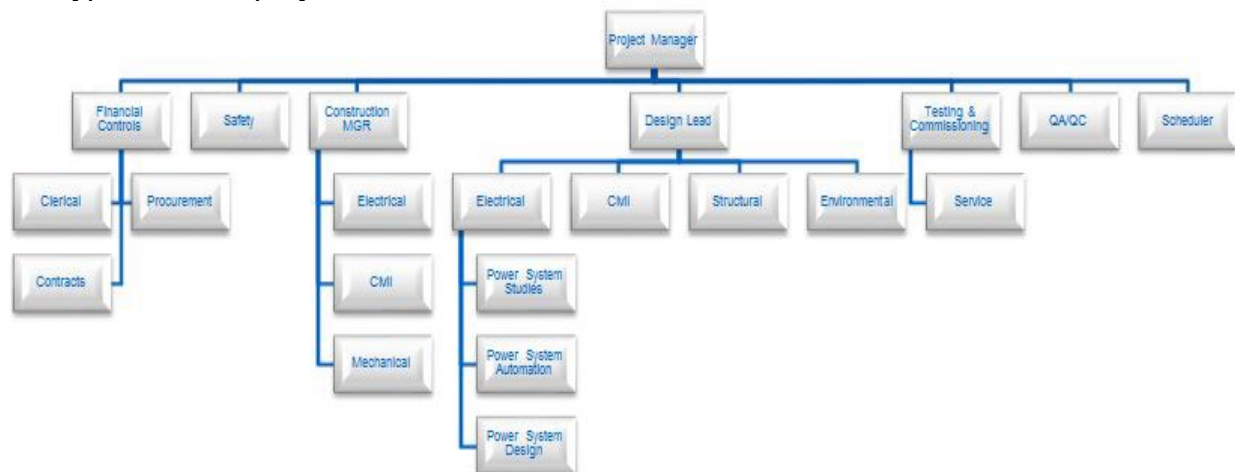
financing models, from the customer's perspective, the project generates an immediate payback and positive ROI from Day 1. Often the financing of these projects includes a long-term contract which generally covers 10-20 years although specific projects or markets may allow for shorter- or longer- term contracts.

Section 2 Roles Eaton Would Fulfill

A project such as this would be executed by Eaton's Electrical Engineering Systems & Services Division (EESS). We would envision fulfilling the following roles:

- Power Systems Engineer
- Project Design Engineer
- Power Systems Control Engineer
- Project Manager
- Construction Manager
- Scheduler
- Safety Officer

The typical Eaton project team could be as shown below:



EESS has many years of relevant experience in the design and installation of electrical power systems and microgrids.

Section 3 Additional Roles Eaton Could Fulfill

During the development stage, it is often necessary to evaluate potential projects for technical and financial feasibility. This project development considers many aspects including site suitability for deployment of solar and wind generation, load profiles, utility rate structures, and many other factors. Eaton and its partners can provide technical site assessments, conceptual designs, and techno-economic analysis to support screening of potential projects.

Section 4 Overview of Challenges & How to Mitigate

Reviews and approvals can often take longer than planned and ensuring all key stakeholders are aware of their role in the review process to ensure key aspects of submittals are addressed (reviewed and approved) can minimize delays and ensure review completeness. For example, design drawings should be reviewed by the appropriate discipline. The key is to establish a workflow to ensure timely processing.

While construction may take months and years, planning, and coordination with appropriate agencies and groups to ensure work proceeds with little to no disruptions; periodic planning and coordination meetings should be established to identify and discuss key/critical tasks completion. A solid schedule is critical to avoiding unnecessary delays and the schedule should be shared with all stakeholders. Establishing requirements and ensuring an audit and tracking methodology.

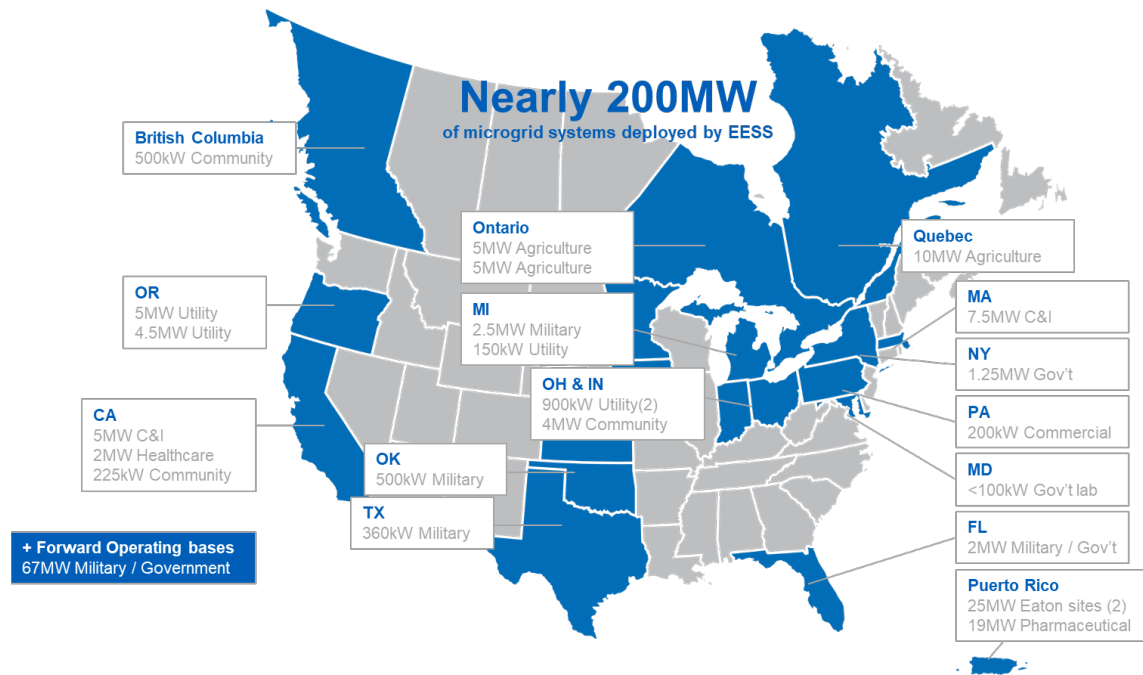
Section 5 Typical Timeline

The size and complexity of the microgrid will determine the timeline. There are many factors that can influence the timeline: equipment and material, sizes, manufacturing lead times, whether land is available and approved for use, etc. For a large complex microgrid project that may include energy storage, solar PV, alternative power sources, it could take 18 – 24 months for the design and build out.

Section 6: Published Case Studies

The maps below outline a resumé of Eaton's extensive microgrid experience from nearly a decade designing and installing turnkey systems in North America. These microgrid projects include a wide range of DER integrations with both front-of-the-meter and behind the-meter applications providing customer's revenue streams in addition to increasing their power reliability and resilience in the event of a grid outage.

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Notable turnkey Microgrid and/or energy storage projects that Eaton has completed or are in process include:

PGE Microgrid: Eaton worked with PGE and EnerDel to integrate a [5MW, Li-ion battery energy storage system](#) to deploy a sophisticated control interface for operation of the energy storage system in a variety of modes.

Ft Sill Microgrid: Eaton designed and built a [Microgrid at Fort Sill](#) composed of two natural gas generators, a battery energy storage inverter, renewables, and a static switch. Design considerations for this retrofit application with a high penetration of dynamic loads are given.

Fort Custer Microgrid: Eaton worked with Fort Custer, Consumer's Energy (CE) and the Battle Creek, MI Air Guard base to develop a [Microgrid that would provide energy surety for Fort Custer](#), the base and the local VA Hospital that utilized existing CE infrastructure and Fort Custer distributed generation assets and Eaton commercial-off-the-shelf control components.

Arecibo, PR Microgrid: Eaton and ENEL X partnered to design and install a [microgrid at the Eaton Arecibo, PR facility](#).

Remote Microgrids: Eaton has designed and built several Microgrids to service remote villages/communities. These microgrids are typically designed to reduce emissions and

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energy costs using the Power Xpert Energy Optimizer microgrid controller and distributed generation assets such as solar PV, energy storage and generators.

Section 7: Technical Marketing materials

The EESS Division can execute a wide variety of work scopes. A bulleted list of areas where we specialize is shown below:

- [Microgrid/Distributed Generation power system design](#)
- [Microgrid control system design](#)
- Single and Multi-site [power system studies](#)
- Energy audits and surveys
- [Turn-key design/build substation projects](#) (concept to construction)
- Turn-key design/build mission critical expansion projects (concept to construction)
- Power system modernization, life extension, and/or technology upgrades (including design, equipment procurement and installation)
- Relay and protective scheme design and implementation
- [Power factor correction design](#) and implementation
- [Power system automation projects](#), including power management control systems, transfer schemes, SCADA systems, load shedding, and generator control
- [Power system monitoring](#), including design, implementation and remote oversight
- Long/short term electrical maintenance projects on power distribution equipment; AC or DC, low, medium, or high voltage, rotating or static equipment
- Uninterruptible power supply projects, including design, equipment supply, installation and maintenance

Section 8: Detailed Company Profile

Overview

Eaton Corporation is a diversified power management company operating for over 100 years. The company operates through various segments, including electrical products, electrical systems and services, aerospace, vehicle, and most recently eMobility. Eaton's portfolio can broadly be divided into two halves. One part of its portfolio is housed under its industrial sector umbrella, which serves a large variety of end markets like commercial vehicles, general aviation, and trucks. The other portion is Eaton's electrical sector portfolio, which serves data centers, utilities, and the residential end market, among others.

The Electrical Sector's (Electrical Engineering Systems & Services (EESS) Division has over 1600 people globally, with 1000 Engineers & Technicians in over 100 locations, formed to respond to industry needs for proficient design, consulting, maintenance and

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modernization of electrical systems. Our group can most often minimize the total cost of any engineering service activity or work scope with highly qualified, properly equipped, and experienced personnel.

EESS has its own in-house professional engineering and consulting organization. Our Power Systems Engineers (PSE) group presently has approximately 80+ engineers in the United States and Canada and is growing every year.

- Average 15 years' experience - multiple manufacturers experience
- Greater than 50% have EE master's degree
- Licensed Professional Engineers - USA and Canada
- Centralized Core group with field deployed resources / engineers
- Active on standards committees / recognized industry experts.
- Electrical substation design thru 345kV
- BESS, microgrid and EVCI electrical system design
- Ancillary foundation, mechanical and civil design
- Low voltage and medium voltage distribution design
- Power System Studies: Power Quality & Harmonic Analysis, Short Circuit/Coordination, Arc Flash Protection, Automation and Control Scheme design

EESS can execute projects as they pertain to electrical distribution systems engineering design, automation and control systems, and utility substations design worldwide. Eaton manages and performs project services for all kinds and sizes of electrical power distribution projects regardless of whether the project is an existing plant expansion, modernization, or new construction, including all ancillary civil, mechanical and structural work which may be required to provide a complete electrical distribution solution.

Eaton's Corporate Offices are in the Cuyahoga County located in Beechwood. In addition to our Beachwood headquarters, Eaton maintains two assembly plants, one research & development facility and two services/sales offices in Ohio. Eaton's EESS group has a national footprint of field service personnel including a field office in Parma, OH. The local team can be leveraged for several key aspects of the project such as electrical upgrades, electrical installation, commissioning, and ongoing operations and maintenance. Eaton is qualified to provide reliable and timely service response for projects like this.

While Eaton is a manufacturer of electrical equipment, the EESS division is a solutions-based organization and open to the inclusion of equipment from any manufacturer that supports the selected design solution.

Environmental

Eaton is committed to minimizing the environmental impact of our operations and products wherever we do business and to continuously improve our Environmental,

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Health and Safety (EHS) performance. It is the responsibility of every employee to comply with this EHS policy.

To that end, Eaton applies a standard group of practices worldwide for energy and water consumption, waste generation, employee safety and more. The results of these efforts are summarized in the [Eaton 2021 Sustainability Report](#).

Section 9: RFI Appendix Questions & Answers

Vision

Q. How might the County Utility improve services compared to traditional systems?

A. Current utilities provide one source of power to all, under a microgrid strategy we can develop customized power supplies based on a customer's requirements. These systems can be designed to have service level agreements and different tariff structures based on these agreements and address key customer goals such as achieving ESG goals, resiliency and cost effectiveness.

Q. How would you propose building a system in a manner that constrains costs based upon available loads, yet is flexible enough to adapt to new end users who are attracted to the system?

A. The only way to effectively achieve this is to have distributed generation resources come on-line with additions of new customers. The thought would be to have a modular generation base that would be expandable as the microgrid customer base grows (ensuring that there would be reserve supply available for backup). This would only require capital outlay for generation and an outlay of capital as required as the customer base grows. This would eliminate the need to overbuild the system initially and tie up capital without a revenue stream to recoup these costs.

Initiative Timelines

Q. What is a typical development time for a microgrid, from customer recruitment through operation?

A. There is no typical development time for a microgrid as the size, complexity and the customer's interest in the microgrid will drive the development time.

Q. What are the major milestones?

A. Milestones may include: gaining commitment from customers, project kickoff, feasibility study (techno-economic study), conceptual design, 30% - 60% - 100% design package, procurement of major equipment, permit submittal and approval, construction start, substantial completion, test and commission, permission to operate, transfer of ownership.

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Q. What impact on this initiative do you foresee, if any, from the current supply chain disruptions?

A. The impact can be higher costs and longer lead times although rising prices due to inflation have compounded supply chain issues. Supply of raw material is causing issues/delays with manufacturing of finished goods/equipment and there is uncertainty as to how long these impacts will last.

Technology

Q. What technologies should the County consider to address power issues for commercial and industrial customers? (power quality issues vs. short power outages vs. long power outages)

A. Resiliency assets (Natural Gas, Diesel, fuel cells), communication and control infrastructure to attempt unplanned islanding, shorter term assets to ride through the transition (BESS, synch condenser, rotary UPS). For more voltage sensitive customers, they may be interested in UPS (Uninterruptible Power Supply) systems, synchronous condensers or other voltage ride through technologies.

Q. Are there ranges of economic feasibility that the County should be aware of when considering on-site generation, storage, etc. For example, do projects only over X MW prove to be economically feasible in your experience?

A. A project is typically feasible if 1) the kWh purchased from the utility is expensive, 2) the utility charges for peak demand and the customer loads are cyclical and 3) If the loss of the utility for an extended time causes large costs for the customers loads, whether in lost product, lost productivity, or excessive labor to return from a power outage.

For generation assets you could use the following budgets:

- Gas generation \$2000/KW
- Ground mounted solar \$1.75-\$2.50 a watt
- BESS \$750K / 1MW1MWH
- 15KV feeder overhead \$200/ft
- 15KV feeder underground \$300/ft

Q. What is your approach to managing: capacity and transmission peak load contributions? Energy market arbitrage? Frequency regulation?

A. Cybersecurity must be addressed at all levels of the distribution system. All the customer's microgrids, assets and utility must be diligent in securing all elements of the system against cyberattacks. Therefore, a comprehensive holistic approach will need to be developed and adhered to for security protection. Eaton can provide cybersecurity support and services to all levels of a microgrid and distribution system.

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Diversity, Equity, and Inclusion

Q. How will you ensure Diverse, Equitable and Inclusive (DEI) partnership(s) throughout this Initiative?

A. Eaton has a corporate diversity, equity and inclusion policy which can be shared and we take positive steps to achieve or exceed goals set by RFP's state and local governments. Our beliefs related to this are captured in our [2022 Global Inclusion and Diversity Report](#).

Other

Q. What potential risks, setbacks, or hurdles do you see for this Initiative?

A. Physical location of the DER assets.
Physical distribution line construction.
Legal process for creating a utility and participating in the markets.
Continued Utility maintenance
Understanding and meeting Public Utility Commission requirements and right-of-ways

Cc: Brett English, Eaton Lead Sales Engineer
Bob Kirsliis, Eaton Sr. Microgrid Specialist

Success Story:

Turnkey substation modernization

Market Served
Food and beverage manufacturing



Eaton designed and built a new substation for a national food and beverage manufacturer's facility concerned with downtime during expansion

Location:
Northeast, US

Segment:
Food and beverage manufacturing

Solution:
Turnkey substation modernization

Problem:
How to address growing demand without causing disruptions

Results:
Eaton served as a "one-stop" shop and delivered a 69kv substation with two new step down transformers, provisions for two future transformers and two full 5kV main-tie-to-main switchgear lines ups offering full redundancy to accommodate expected customer loads with provisions for future growth.

"The customer not only benefited in the short term cost savings and design advantages, but Eaton also provided solutions and the necessary platform that will address potential future concerns."

Background

An established food and beverage manufacturer faced a challenging situation; how to address growing demand without causing service and manufacturing disruptions. There are typically three options – expand the existing facility, build a brand-new facility, or purchase and refurbish an existing facility.

Regardless of the solution implemented, the customer was faced with almost doubling the size of the existing power distribution system, which would require building a new substation or significantly expanding the existing infrastructure.

Challenge

Determine the best solution to enable growth in the manufacturing facility, while coordinating with local utility provider and complying with all standard requirements.

Solution

Eaton has been involved in high voltage substation construction for over 20 years and is ideally suited to undertake a substation project of this magnitude; long project duration requiring multiple disciplines including engineers, construction managers and project managers. Eaton worked with a consulting firm that acted as a liaison with the customer. Eaton provided a comprehensive turnkey / EPC solution for the 69kV to 5kV substation, providing different priced alternatives and conceptual designs best suited to the customer.

Once the customer decided to expand the existing facility, Eaton looked at areas next to the existing substation and concluded that building a new substation adjacent to the existing substation could minimize downtime and outages during load transfer. There were multiple discussions with the consultant and the customer that centered around the technical details – transition between old and new substations and connection between the outdoor substation and facility load, power ratings, redundancy and resiliency in terms of cost benefit features with the new equipment.



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From a technical point of view, the customer's existing facility had two 69kV lines coming into a Main-Tie-Main arrangement through two overloaded step down transformers that were over 40 years old. Eaton's proposed solution involved a 69kV substation with two new step down transformers, provisions for two future transformers, two full 5kV main-tie-to-main switchgear lines ups offering full redundancy to accommodate expected customer loads with provisions for future growth.

Resiliency and redundancy were important factors for the customer and Eaton's solution met those requirements by providing two new 12 MVA transformers so that if one of the transformers goes offline, the other transformer can run the plant with sufficient capacity.

Eaton also designed the solution to meet potential future requirements – base arrangement with concrete foundations, grounding and conduits were provided, enabling the customer to add two more transformers in the future if necessary, without any major hassle or downtime.

Eaton designed and built a block building complete with a cable vault to house the 5kV switchgear, control panel, station service loads, and battery system.

The overall solution was designed with safety as a top priority while also performing regular maintenance without causing any downtime and load shortages. The customer could control the equipment from a remote panel within their office. Integral remote racking was provided to enhance safety by placing distance between maintenance personnel and operation of the switchgear.

Results

Eaton completed the project within the customer's timeframe, leveraging in-house expertise to provide the best-in-class, turnkey solution coordinating with the customer, consulting firm and the utility. The project provided the customer:

- **A safer substation**

The existing substation required the customer to call the utility every time any type of switching was needed. Due to the equipment's age, this could have resulted in downtime in the facility. The new equipment recommended and installed by Eaton allowed autonomous switching of the transformers without calling the utility. Eaton's fully redundant substation improves the safety and reduces the likelihood of potential production and revenue loss for the next 40-50 years.

- **Cost savings**

Eaton angled the yard for the substation eliminating the need for an additional 69kV utility pole and lines, saving the utility both money and time. Also the 5kV switchgear was constructed with a cable vault underneath providing flexibility to swap and add loads providing potential future cost savings.

- **The design advantages**

Eaton built a custom protection house to fit all the customized controls into the substation. The protection house was fabricated and tested offsite prior to installation to minimize installation and onsite commissioning. The provision for two future transformers significantly eases the customer's engineering requirements allowing for potential future expansion of the facility.

Summary

In summary, Eaton provided a solution that met the customer's current demand requirements, provided cost savings through design advantages and developed solutions to meet the customer's future needs.



Block building containing switchgear



Duplex control board complete with HMI, control switches and 69kV relays (on opposite side, not shown)

To learn more, visit [Eaton.com/services](https://www.eaton.com/services)

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Printed in USA
Pub No: CS027007EN / GG
November 2019

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